Remarks

Support for the above-requested amendments to claims 1 and 21 is found at least at paragraph [0021] of the specification. Claims 3 and 13 have been amended for grammatical reasons, and not for any reasons related to patentability. Claim 24 has been canceled without prejudice. Claims 17 – 20 and 22 were canceled in previous Amendments Applicants respectfully submit that these amendments are proper despite the finality of the outstanding Office Action because the amendments place the application in condition for allowance and/or place the application in better form for appeal. No question of new matter arises and entry of the amendments is respectfully requested.

Claims 1 - 16, 21, and 23 are before the Office for consideration.

Rejection under 35 U.S.C. §112, first paragraph

Claim 24 has been rejected under 35 U.S.C. §112, first paragraph as failing to comply with the written description requirement. In particular, the Office asserts that claim 24 is indefinite as to its limiting effect. The Office notes that in one interpretation of the claim, there appears to be insufficient support in the specification for employment of a plurality of nanoparticle materials. In addition, there does not appear to be support in the specification to limit the claim to employ nano-particles of calcium carbonate, intercalated graphites, and expanded graphites and to employ an additional nano-particle nucleating agent.

Applicants have canceled claim 24 without prejudice, thereby rendering the rejection of this claim moot.

Rejection under 35 U.S.C. §112, second paragraph

Claims 1 - 16, 21, 23, and 24 have been rejected under 35 U.S.C. §112, second paragraph as being indefinite. In particular, the Office asserts that the claims are indefinite because there is no unit of measure associated with the number 100. In addition, the Examiner asserts that claim 24 is indefinite because it is unclear whether the nano-particles and the nano-particle nucleating agents are different nano-materials or if they are the same material.

Initially, Applicants submit that claim 24 has been canceled without prejudice, thereby rendering the rejection of this claim moot.

With respect to the rejection of claims 1 and 21, Applicants note that in the

Amendment filed on September 8, 2006, there is an underlined space after the recitation of "100" where the symbol for the unit "angstrom" was to have been printed. Therefore, in response to this rejection, Applicants have amended claims 1 and 21 to recite the unit "angstroms" after "100" as originally intended.

As amended, Applicants submit that claims 1 and 21, and all claims dependent therefrom, are sufficiently definite and respectfully request that this rejection be reconsidered and withdrawn.

Rejection of Claims 1 - 16 under 35 U.S.C. §103(a)

Claims 1 - 16 have been rejected under 35 U.S.C. §103(a) as being unpatentable over WO 2001/39954 to Grinshpun *et al.* ("Grinshpun") in view of U.S. Patent No. 6,795,446 to Lee *et al.* ("Lee") or U.S. Patent No. 6,617,295 to Nitzsche ("Nitzsche"). The Office asserts that Grinshpun teaches a method of manufacturing a rigid foam that includes (1) incorporating nanoparticle fillers, calcium carbonate, or clays into a polymer, (2) incorporating a blowing agent into the melt under a first temperature and a first pressure, (3) extruding the polymer melt under a second temperature and second pressure, and (4) cooling the foamed product to allow the polymer melt to expand the foam. It is asserted that the foam has a cell size ranging from 25 - 7000 microns. Grinshpun does not explicitly teach that the nanoparticle fillers are nano-clays or intercalated or expanded graphite. Grinshpun also does not teach the particle size of the calcium carbonate. However, it is asserted that Lee and Nitzsche teach methods similar to Grinshpun that disclose the use of nano-clays and calcium carbonate. In addition, the Office asserts that Lee teaches nanoclays that have a size in at least one dimension less than 100 nm. The Office concludes that it would have been obvious to one of skill in the art to take the method of Grinshpun and modify it with the nano-clay additives taught by Lee or Nitzsche to improve the physical properties of the foam.

In response to this rejection, Applicants respectfully direct the Office's attention to independent claim 1 and submit that claim 1 defines a method of manufacturing a rigid foam that is not taught or suggested within Grinshpun, either alone or in combination with Nitzsche or Lee. Grinshpun teaches a method for preparing a foam structure that includes hollow, coalesced foam strands. (*See, e.g.*, Abstract and page 1, lines 6 - 9). Optionally, the foam structure may include solid, coalesced strands. (*See, e.g.*, page 1, lines 9 - 12). The first step of the process includes providing a foamable composition that includes a blowing agent

composition and at least one film forming composition. (*See, e.g.*, page 2, lines 16 - 18 and page 20, lines 9 - 11). The foamable composition is preferably a foamable polymer such as an olefinic homopolymer. (*See, e.g.*, page 20, lines 11 - 13). Optionally, the foamable composition may include at least one additive or modifier selected from fire retardant chemicals, stabilizers, antioxidents, colorants, permeability modifiers, plasticizers, static dissipative agents, anti-static agents, surfactants, and opacifiers. (*See, e.g.*, page 20, lines 16 - 22). The blowing agent composition must effect a foaming of the film forming composition. (*See, e.g.*, page 3, lines 20 - 21). The foamable composition is in a gel state. (*See, e.g.*, page 2, line 18 and page 20, line 15). Next, the foamable composition is extruded through a die that has a plurality of orifices, each of which forms a hollow extrudate. (*See, e.g.*, page 2, lines 19 - 21 and page 20, lines 22 - 24). The hollow extrudate is converted into foamed hollow extrudate strands at a temperature that promotes bubble stability. (*See, e.g.*, page 2, lines 22 - 24 and page 20, lines 26 - 28). The final step includes permitting the hollow strands to contact and adhere to each other to form a hollow, multistrand polymer foam extrudate. (*See, e.g.*, page 2, lines 25 - 28 and page 20, lines 28 - 31).

Applicants respectfully submit that Grinshpun does not teach or suggest a method of forming a rigid foam that includes (1) incorporating nano-clays, calcium carbonate, intercalated graphites, or expanded graphites that have a particle size in at least one dimension less than 100 angstroms in a polymer melt, (2) incorporating a blowing agent into the polymer melt at a first temperature and pressure, (3) extruding the polymer melt at a second temperature and pressure to allow foaming, and (4) cooling the foam to form a foam product that has an average cell size that is greater than approximately 60 μm as claimed in amended claim 1. Although Grinshpun teaches a foamable composition that is extruded into a foamed product, the foamable composition does not teach or suggest the inclusion of a nano-particle nucleating agent having a particle size in at least one dimension less than 100 angstroms as required by claim 1. As discussed above, certain additives and modifiers may be included in the polymer composition. (*See, e.g.*, page 20m lines 16 - 22 of Grinshpun). However, Grinsphun is silent with respect to any teaching of a nucleating agent that has a particle size in at least one dimension less than 100 angstroms. None of the recited modifiers of Grinshpun are defined with a specific particle size.

Nitzsche teaches a method for foaming a resin and a composition that may be used to induce the foaming of a resin when passed through processing machinery. (*See, e.g.*,

Abstract and column 1, lines 41 - 44). The method includes (1) blending a composition that includes a blowing agent, a filler, a surfactant, and a binder with a polymeric material to form a mixture, (2) processing the mixture in a polymeric processing apparatus, and (3) forming a molded article from the mixture. (*See, e.g.*, column 1, lines 60 - 66).

Lee teaches the use of nano-sized particles to form a microcellular foam that has a high density and a small cell size (*e.g.*, less than 5 microns). (*See, e.g.*, Abstract). The disclosed method for forming a polymeric foam with such a small cell size includes (1) providing a mixture of a polymer, an organophilic clay, and a blowing agent and (2) processing the mixture to cause the formation of cells. (*See, e.g.*, column 2, lines 30 - 35).

In the Office Action dated January 25, 2006, at page 3, lines 8 - 12, it was asserted that Lee teaches a cell size greater than approximately 60 μm in claim 10, and, as a result, anticipated claim 1. Claim 10 of Lee recites that the "polymeric nanocomposite foam has an average cell size greater than about 15 microns." (*See*, column 12, lines 9 – 11 of Lee). However, when analyzing the enabled scope of a claim, "the teachings of the specification must not be ignored because claims are to be given their broadest reasonable interpretation that is consistent with the specification." (*See, e.g., Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 3, August 2005, §2164.08).

Lee specifically teaches that by controlling the carbon dioxide content, the melt and die temperatures, and pressure drop rate, a microcellular foam is formed that has a very high cell density (*i.e.*, $>10^9$ cells/cm^3) and a small cell size (*i.e.*, <5 μm). (*See, e.g.*, Abstract). Lee also teaches that it is preferred that the polymeric nanocomposite foam has an average cell size less than about 20 μm and greater than about 15 μm. (*See, e.g.*, column 3, lines 31 - 35 and column 4, lines 24 - 28). In column 7, lines 48 - 60, in the preferred embodiment of the invention, the calculated cell size was 4.9 μm. Thus, in view of the teachings set forth in Lee and the procedural rules set forth in MPEP §2164.08, claim 10 must be interpreted as a polymeric nanocomposite having a cell size between about 15 μm and less than about 20 μm, and cannot be interpreted to encompass a cell size of 60 μm or greater as is claimed in claim 1.

In view of the teachings of Lee, it is respectfully submitted that one of skill in the art would not be motivated to utilize the nanoparticles of Lee in the method of Grinsphun. To establish a *prima facie* case of obviousness, there must be some motivation, either within the reference or in the knowledge of those of skill in the art, to modify the reference or combine

the references' teachings, there must be a reasonable expectation of success, and the prior art references must meet all of the claim limitations. (*See, e.g., Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 3, August 2005, §2142). One of ordinary skill in the art simply would not be motivated to arrive at the presently claimed method of manufacturing a rigid foam that includes incorporating nano-particles having a particle size in at least one dimension less than 100 angstroms into a polymer melt, incorporating a blowing agent into the polymer melt under a first pressure and at a first temperature, extruding the polymer melt under a second pressure and at a second temperature sufficient to allow the polymer melt to expand and form a foam, and cooling the foam to form a foam product having an average cell size greater than 60 μm as claimed in claim 1 because the nanoparticles of Lee result in a foam product with a cell size less that is less than 20 μm, and in preferred embodiments, less than 5 μm. On the other hand, the method of Grinshpun forms foams that have cell sizes up to 7,000 μm. Based on the disclosure of Lee, one of skill in the art would conclude that the small nanoparticles taught by Lee produce very small cell sizes (*e.g.*, < 5μm) and, as a result, would not be motivated to incorporate these nanoparticles in the method of Grinshpun to achieve a foam with a large cell size. Moreover, a person ordinarily skilled in the art would not have a reasonable expectation of success in forming the large cell sizes taught by Grinshpun because Lee clearly demonstrates the formation of a foam with a cell size less than 5 μm utilizing the nanoparticles of Lee. Without some motivation to combine the references, and a reasonable expectation of success, there can be no *prima facie* case of obviousness.

Applicants further submit that the teachings of Lee would lead one ordinarily skilled in the art away from utilizing the nanoparticles of Lee in the method of Grinshpun due to the small cell size formed by the nanoparticles of Lee. It is respectfully submitted that one of skill in the art would not look to the nanoparticles of Lee to achieve a particle size of greater than 60 μm as claimed in claim 1.

With respect to Nietzsche, Applicants respectfully submit that the combination of Grinsphun and Nietzsche would not result in the invention claimed in claim 21. Nietzsche does not teach or suggest nanoparticles that have a particle size in at least one dimension less than 100 angstroms as claimed in claim 1. Although Nitzsche teaches the optimal inclusion of a nanocomposite, Nitzsche is silent as to the size of the disclosed nanocomposite. As discussed above, Grinshpun does not teach or suggest the size of the added modifiers.

Accordingly, the combination of Grinsphun and Nitzsche fails to constitute the substantial evidence necessary to render the claimed invention obvious as a matter of law. (*See, e.g., In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596, 1599 (Fed. Cir. 1988) (holding it error to find obviousness where references as a whole "diverge from and teach away from the invention at hand."))

With respect to claims 2 - 16, Applicants submit that because independent claim 1 is not taught or suggested by Grinshpun, Lee, and Nitzsche and claims 2 - 16 are dependent upon independent claim 1 and contain the same elements as claim 1, dependent claims 2 - 16 are also not taught by Grinshpun, Lee, and/or Nitzsche.

In light of the above, Applicants submit that claims 1 - 16 are not obvious over Grinshpun in view of Lee or Nitzsche and respectfully request that this rejection be reconsidered and withdrawn.

Rejection under 35 U.S.C. §103(a)

The Office has rejected claims 21 and 23 under 35 U.S.C. §103(a) as being unpatentable over WO 2001/39954 to Grinshpun *et al.* ("Grinshpun") in view of U.S. Patent No. 5,010,112 to Glicksman *et al.* ("Glicksman"). In particular, the Office asserts that Grinshpun teaches the claimed method with the exception of the shape of the calcium carbonate. Glicksman is cited as teaching that the calcium carbonate is acicular. It is concluded that it would have been *prima facie* obvious to one of ordinary skill in the art to use the acicular calcium carbonate for the purpose of improving the insulating properties of the foam.

In response this rejection, Applicants respectfully direct the Examiner's attention to claim 21 and submit that claim 21 defines a method of manufacturing a rigid foam that is not taught or suggested by Grinshpun and/or Glicksman. With respect to Grinshpun, Applicants submit that the method of Grinshpun is discussed in detail above, and for purposes of brevity, the method of Grinshpun will not be discussed in detail with respect to this rejection.

With respect to Glicksman, Glicksman discloses a closed cell, rigid, polymer foam that is formed with filler particles in the form of flakes or spheres dispersed throughout the foam. (*See, e.g.*, column 2, lines 44 - 46). The particles are formed of non-metallic, non-opaque materials coated with an opaque material such as graphite, aluminum, or carbon black. (*See, e.g.*, column 2, lines 46 - 48 and 59 - 62). The coated filler lowers the thermal

conductivity and lowers the radiation heat transfer. (*See, e.g.*, Abstract and column 2, line 66 - column 3, line 1).

Applicants respectfully submit that Grinshpun and/or Glicksman do not teach or suggest (1) incorporating acicular nano-particles and at least one nucleating agent into a polymer melt that includes an alkenyl aromatic polymer material where the nano-particles have a particle size in at least one dimension less than 100 angstroms, (2) adding a blowing agent to the polymer melt under a first pressure and at a first temperature, (3) extruding the polymer melt under a second pressure and at a second temperature, where the second pressure and second temperature are sufficient to allow the polymer melt to expand and form a foam, and (4) cooling the foam to form a foam product. Neither Grinshpun nor Glicksman teach or suggest nanoparticles that have a particle size in at least one dimension less than 100 angstroms. As a result, Applicants respectfully submit that the combination of Grinshpun and Glicksman would not result in the presently claimed invention. In view of the above, Applicants submit that claim 21 is non-obvious and patentable.

Additionally, Applicants submit that there is no motivation for one of skill in the art to arrive at the invention claimed in claim 21 based on the disclosures of Grinshpun and Glicksman. As discussed above, in order to establish a *prima facie* case of obviousness, there must be some motivation, either within the reference or in the knowledge of those of skill in the art, to modify the reference or combine the references' teachings, there must be a reasonable expectation of success, and the prior art references must meet all of the claim limitations. (*See, e.g., Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 3, August 2005, §2142). It is submitted that one of ordinary skill in the art would not be motivated to arrive at the method claimed in claim 21 based on the teachings of Grinshpun and/or Glicksman when Grinshpun and Glicksman both fail to teach or suggest nanoparticles that have a particle size in at least one dimension less than 100 angstroms. Without some teaching or suggestion, there can be no motivation, and without motivation, there is no *prima facie* case of obviousness. Applicants submit that claim 21 is patentable over Grinshpun and/or Glicksman for this additional reason.

With respect to claim 23, Applicants submit that because independent claim 21 is not taught or suggested by Grinshpun and/or Glicksman and claim 23 is dependent upon independent claim 21 and contains the same elements as claim2 1, dependent claim 23 is also not taught or suggested by Grinshpun and/or Glicksman.

In view of the above, Applicants submit that claims 21 and 23 are not obvious over Grinshpun in view of Glicksman and respectfully request that the Office reconsider and withdraw this rejection.

Rejection under 35 U.S.C. §103(a)

The Office has rejected claim 24 under 35 U.S.C. §103(a) as being unpatentable over WO 2001/39954 to Grinshpun *et al.* ("Grinshpun") in view of U.S. Patent No. 6,589,646 to Morgenstern ("Morgenstern") or U.S. Patent No. 6,617,295 to Nitzsche ("Nitzsche"). In particular, the Office asserts that Grinshpun teaches the claimed method with the exception of the particle size of the calcium carbonate. It is asserted that Morgenstern teaches the particle size of the calcium carbonate is preferably in the range of 10 to 1000 nanometers and that Nitzsche teaches the particle size of the nucleating agent impacts the cell structure. The Office concludes that it would have been obvious to one of ordinary skill in the art to use the calcium carbonate taught by Morgenstern and Nitzsche in the method of Grinshpun because the particle size of the nucleating agent is a result effective variable for the cell structure. In addition, it is asserted that the particle size of the nucleating agent would have been readily optimized as is routinely practiced in the art.

Applicants have canceled claim 24 without prejudice, thereby rendering this rejection moot. Accordingly, Applicants respectfully request that this rejection be withdrawn.

Conclusion

In light of the above, Applicants believe that this application is now in condition for allowance and therefore request favorable consideration.

If any points remain in issue which the Office feels may be best resolved through a personal or telephone interview, the Office is kindly requested to contact the undersigned at the telephone number listed below.

Application No. 10/722,929
Attorney Docket No: 25226A

If necessary, the Commissioner is hereby authorized to charge payment or credit any overpayment to Deposit Account No. 50-0568 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

Date: _____

/Maria C. Gasaway/
Maria Gasaway
Registration No. 51,721

Owens Corning
Patent Department, Bldg. 11
2790 Columbus Road
Granville, Ohio 43023
(740) 321-7213